

***Marsdenia maingayi* (Apocynaceae: Asclepiadoideae), a rare rainforest woody climber rediscovered in Singapore**

Y.S. Yeoh¹, C.K. Yeo², W.F. Ang³ and Y.W. Low⁴

¹NUS High School of Mathematics and Science,
20 Clementi Avenue 1, 129957 Singapore
wywyas@gmail.com

²Office of the Chief Science and Technology Officer,
Ministry of Home Affairs, New Phoenix Park,
28 Irrawaddy Road, 329560 Singapore
yeo_chow_khoon@mha.gov.sg

³Horticulture and Community Gardening Division, National Parks Board,
100K Pasir Panjang Road, 118526 Singapore
ang_wee_foong@nparks.gov.sg

⁴Herbarium, Singapore Botanic Gardens, National Parks Board,
1 Cluny Road, 259569 Singapore
low_yee_wen@nparks.gov.sg

ABSTRACT. *Marsdenia maingayi*, a rare rainforest climber previously thought to be extinct in Singapore, was rediscovered in the vicinity of MacRitchie Reservoir, Central Catchment Nature Reserve in July 2012. This is the second sighting of the taxon in Singapore since it was first collected in Changi in 1885—more than 120 years later. Based on this recent discovery, additional observations on the taxon are provided here and the conservation status of this species is revised to Critically Endangered for Singapore. *Marsdenia maingayi* is lectotypified here.

Keywords. Apocynaceae, Asclepiadoideae, Central Catchment Nature Reserve, extinct, lectotypification, MacRitchie Reservoir Park, *Marsdenia maingayi*, rediscovery, *Stephanotis maingayi*

Introduction

Marsdenia R.Br. (Apocynaceae, Asclepiadoideae) is a genus consisting of about 200 species of twining woody climbers and subshrubs distributed worldwide in the warm tropical and subtropical regions (Mabberley 2008). Robert Brown dedicated the genus to the First Secretary of the British Admiralty, William Marsden (1754–1836), who was an authority on Sumatran history and an avid promoter of botany (Brown 1810). *Marsdenia maingayi* (Hook.f.) P.I.Forst. is an elusive rainforest woody climber endemic to the Malay Peninsula (Peninsular Malaysia and Singapore). It has only been recorded five times (four records from Peninsular Malaysia, and once from Singapore) based on a survey of herbarium materials available in the Herbarium of the

Royal Botanic Gardens, Kew (K), Forest Research Institute Malaysia, Kepong (KEP), and Singapore Botanic Gardens (SING) (herbarium acronym follows Thiers 2013). The species was initially described as *Stephanotis maingayi* Hook.f. (Hooker 1885), based on a collection from Melaka made by Maingay on 23 June 1865 or 1866. Forster (1995a) later recombined it as *Marsdenia maingayi* after conclusive findings based on morphological characters revealed that *Stephanotis* Thouars and *Marsdenia* were taxonomically congeneric (Forster 1995b).

The first collection of the species in Singapore was made by Hullett from Changi in 1885 (Gamble 1908; Ridley 1923). Ridley (1923), however, could not find any living material in Singapore or Peninsular Malaysia and remarked that the species could have gone extinct. As the species was not sighted in Singapore in the more than a century since Hullett's discovery this prompted Tan et al. (2008) and Chong et al. (2009) to list the taxon as Presumed Nationally Extinct in Singapore. However, in 2012 we rediscovered this flowering climber in the vicinity of MacRitchie Reservoir Park and report it here. The conservation status for the species in Singapore is revised, based on Davison (2008).

The IUCN conservation status of *Marsdenia maingayi* is also assessed throughout its range using GeoCAT (Bachman et al. 2011), an IUCN Red List (IUCN 2001) compliant software that generates the IUCN threat categories based on (i) extent of occurrence (EOO), and (ii) area of occurrence (AOO). Data used for the assessment here are based on herbarium records that are represented in three herbaria, i.e., K, KEP and SING.

The discovery at MacRitchie Reservoir Park

The *Marsdenia maingayi* specimen discovered in the vicinity of MacRitchie Reservoir is a vigorous woody climber found just beside a jogging trail, along the forest margin (Fig. 1). The climber was undetected initially, even though the first author made regular visits to the park, as it was growing high up in the tree canopy at about 8–10 m above ground. However, a recent tree fall at the spot eventually brought parts of the climber down, closer to the ground. Subsequently, the climber flowered, and was spotted by the first author in July 2012, who collected a small flowering specimen and forwarded it to SING for identification. The newly collected material was eventually found to match the Hullett collection from Changi. Furthermore, it also matched the type specimens (*Maingay 1731 / Kew Distrib. No. 1112*) in the Herbarium of the Royal Botanic Gardens, Kew (K). Upon ascertaining the identity and rarity of this plant, a second visit to the site was made in August 2012 to properly document, observe and make a herbarium collection of the specimen to be deposited at SING, along with duplicate material of this rare species.

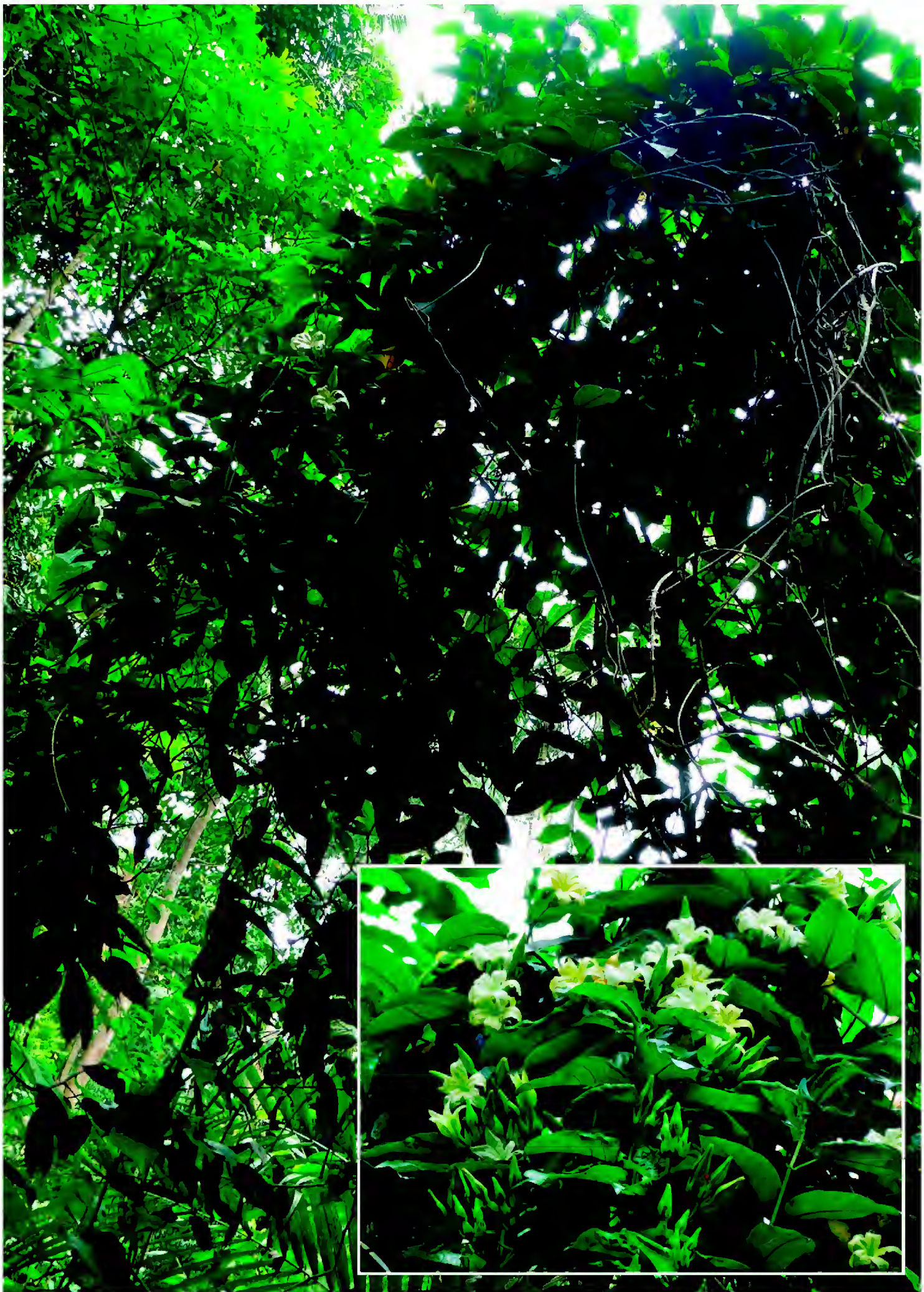


Fig.1. The vigorous MacRitchie specimen of *Marsdenia maingayi* growing along the forest margin, beside a jogging track (Photo: C.K. Yeo). *Inset:* Gregarious flowering observed in July 2012. (Photo: Y.S. Yeoh)

Taxonomy

Marsdenia maingayi (Hook.f.) P.I.Forst., Austral. Syst. Bot. 8(5): 700 (1995). — *Stephanotis maingayi* Hook.f., Fl. Brit. India 4: 39 (1885); Gamble, J. Asiat. Soc. Bengal 74(2): 550 (1908); Ridley, Fl. Mal. Pen. 2: 389 (1923). TYPE: *Maingay 1731*, Peninsular Malaysia, Melaka, 23 Jun 1865–1866 (*Kew Distrib. No. 1112*) (lecto K! barcode K000821736, designated here; isolecto K! barcode K000821737). Fig. 2.

Robust twining woody climber, exudate clear. Indumentum of pale yellow-brown erect unicellular eglandular trichomes on most parts. **Stems** woody, twining, cylindrical, 2–4(–5) mm wide, sparsely pubescent when young, usually glabrous on older parts, older parts lenticellate; internodes (9.2–)10–15.5(–18.5) cm long. Petiole (1.8–)2–2.5(–3) cm long, 1–1.5 mm wide, sparsely pubescent. **Leaf lamina** elliptic to ovate, (8–)9.5–11(–15) cm long, (4.6–)5.5–5.8(–9.5) cm wide, chartaceous; colleters on adaxial surface of the lamina base up to 9, conical, pale to dark brown; lamina base cordate; apex acute to acuminate; venation pinnate, midrib flat to sunken and minutely puberulent on upper surface, prominent and puberulent on lower surface; secondary veins 6–9(–11) pairs, flat and subglabrous on upper surface, prominent and sparsely puberulent on lower surface; tertiary venation reticulate. **Inflorescence** extra-axillary, racemiform, 2.5–6 cm long; peduncles 2.5–5 cm long, 1.7–2 mm wide, sparsely pubescent; bracts narrowly lanceolate, 5–8 mm long, outside sparsely pubescent, inside glabrous. **Flowers** 2–5 per inflorescence, 7.5–9 cm long, 7–8 cm wide; pedicels 2–3.5 cm long, 1–1.8 mm wide, sparsely pubescent. Sepals lanceolate, 1.4–2.4 cm long, 2–3 mm wide at base, 5–10 mm at the widest portion narrowing towards the apex; outside sparsely pubescent, inside glabrous. **Corolla** salver-shaped with right-contorted lobes, white turning pale yellow, then yellow-orange; tube 1.8–2.7 cm long, 4–5.5 mm wide at the mid portion, 4–7 mm wide at throat, outside sparsely pubescent, inside glabrous on most of the upper parts except for narrow V-shaped patches of retrose trichomes around the base of the staminal column; lobes 5, lanceolate, 2–3.2 cm long, 7–11 mm wide, outside sparsely pubescent, inside glabrous. **Staminal corona** 8–9 mm long, up to 5 mm wide, tips overtopping style-head. **Staminal column** up to 12 mm long, up to 5 mm wide; anther appendages with an irregularly hyaline-membranous apex surrounding the style-head, ovate, 4–5 mm long, up to 2 mm wide; alar fissure c. 4 mm long. **Style-head** umbonate, c. 4 mm long, c. 2 mm wide. **Pollinarium** c. 1.2 mm long, c. 1.5 mm wide; pollinium ellipsoid, c. 1 mm long, c. 0.3 mm wide; corpusculum ovate, c. 0.8 mm long, c. 0.7 mm wide; caudicles c. 0.3 mm long, c. 0.1 mm wide. **Fruit** a single follicle, cylindrical-oblong, c. 24.6 cm long, c. 4 cm wide; seeds many, ovate, 1.3–1.5 cm long, 0.7–0.9 cm wide, comose at germinating end, coma c. 8 cm long, golden brown.

Distribution. Endemic to the Malay Peninsula (Peninsular Malaysia and Singapore) (Fig. 3).

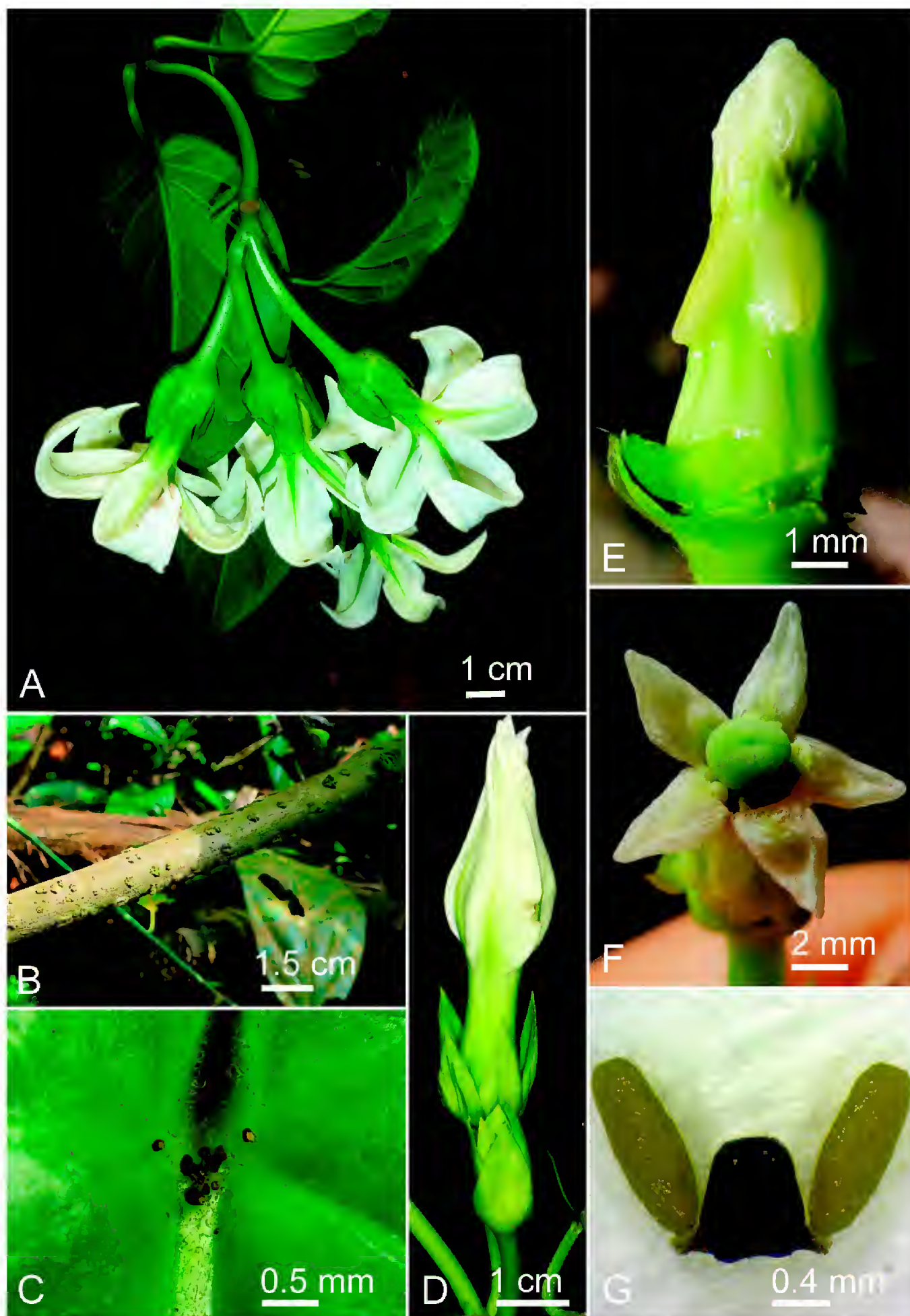


Fig. 2. *Marsdenia maingayi* (Hook.f.) P.I. Forst. **A.** The showy pendulous inflorescence with salver shaped flowers. **B.** Lenticellate bark observed on older woody stems. **C.** Close-up of dark coloured colleters at the base of lamina on adaxial surface. **D.** Flower bud with right contorted corolla lobes. **E.** Close-up of staminal column. **F.** Hyaline-membranous anther appendages artificially forced open to expose the pale green umbonate stigma. **G.** Close-up of a pollinarium showing dark-coloured corpusculum with two pollinia attached. (Photos: A, C.K. Yeo; B–C & E–F, Y.S. Yeoh; D, W.F. Ang; G, Y.W. Low)

Habitat and ecology. Forest margin and open forest gaps of disturbed lowland forests, to 230 m elevation.

Proposed conservation status. *Marsdenia maingayi* is proposed here for Singapore as Critically Endangered (CR), as the MacRitchie specimen is the only mature individual known to exist in the wild. This matches the status proposed in Davison (2008). This is largely due to habitat loss attributed to Singapore's economic transformation and development since colonial times.

Over its entire distribution the IUCN conservation status for *Marsdenia maingayi* is assessed using GeoCAT as Endangered EN B2ab(iii,iv) (IUCN 2001). The B2 designation is given because the Area of Occurrence (AOO) is estimated to be less than 500 km² (about 24 km² for *Marsdenia maingayi*); the 'a' designation because it is known to exist at no more than five locations (Singapore: MacRitchie Reservoir; Peninsular Malaysia: Kuala Aring Forest Reserve (Kelantan), Jengka (Pahang), and Gunung Panti Forest Reserve (Johor)); and the b(iii, iv) category indicates that there is a continuing decline in area and quality of habitat, and number of locations. Habitat loss is a major concern for the species as Peninsular Malaysia and Singapore continue to undergo modernisation. However, these proposed statuses for the species would require reassessment periodically as more efforts are underway in the region to systematically document the flora of Singapore, as well as the flora of Peninsular Malaysia.

Additional notes. Two sheets of the type material, *Maingay 1731* (Kew Distrib. No.: 1112) were present at Kew. As these were not clearly indicated in Forster (1995a), we would here like to designate the sheet identified by barcode K000821736 as the lectotype, while the other sheet (K000821737) is an isotype. At MacRitchie, the flowers of *Marsdenia maingayi* were observed to be visited by lepidopterans, *Quedara monteithi monteithi* (Wood-Mason & de Nicéville 1887), a dark-coloured skipper. A dark-coloured liquid, possibly nectar (Fig. 4), was also observed to be present. The nature of the dark-coloured liquid was not investigated, but was suspected to be produced by the plant as it was sweet to taste. Furthermore, coloured nectar has been recorded for other members of the Asclepiadoideae (*Hoya* R.Br. species) (Hansen et al. 2007). The plant failed to produce mature fruits after the end of the flowering period based on observations carried out by the first author on subsequent visits over a period of six months. *Ex situ* conservation attention for the species has been initiated at the National Parks Board's Pasir Panjang Nursery as this is the only known living specimen to exist in Singapore. As this species certainly has much ornamental value, given its large showy and mildly fragrant flowers that change from white to yellow-orange as they mature, it could be introduced to streetscapes in the near future. Special effort is also needed to protect and preserve this living specimen on site, in the vicinity of MacRitchie Reservoir, as a long term *in situ* conservation effort.

Additional specimens examined: PENINSULAR MALAYSIA. **Kelantan.** Kuala Aring Forest Reserve, 1992, Kiew KBH26 (KEP; SING! barcode no. SING0015422); **Pahang.** Jengka,

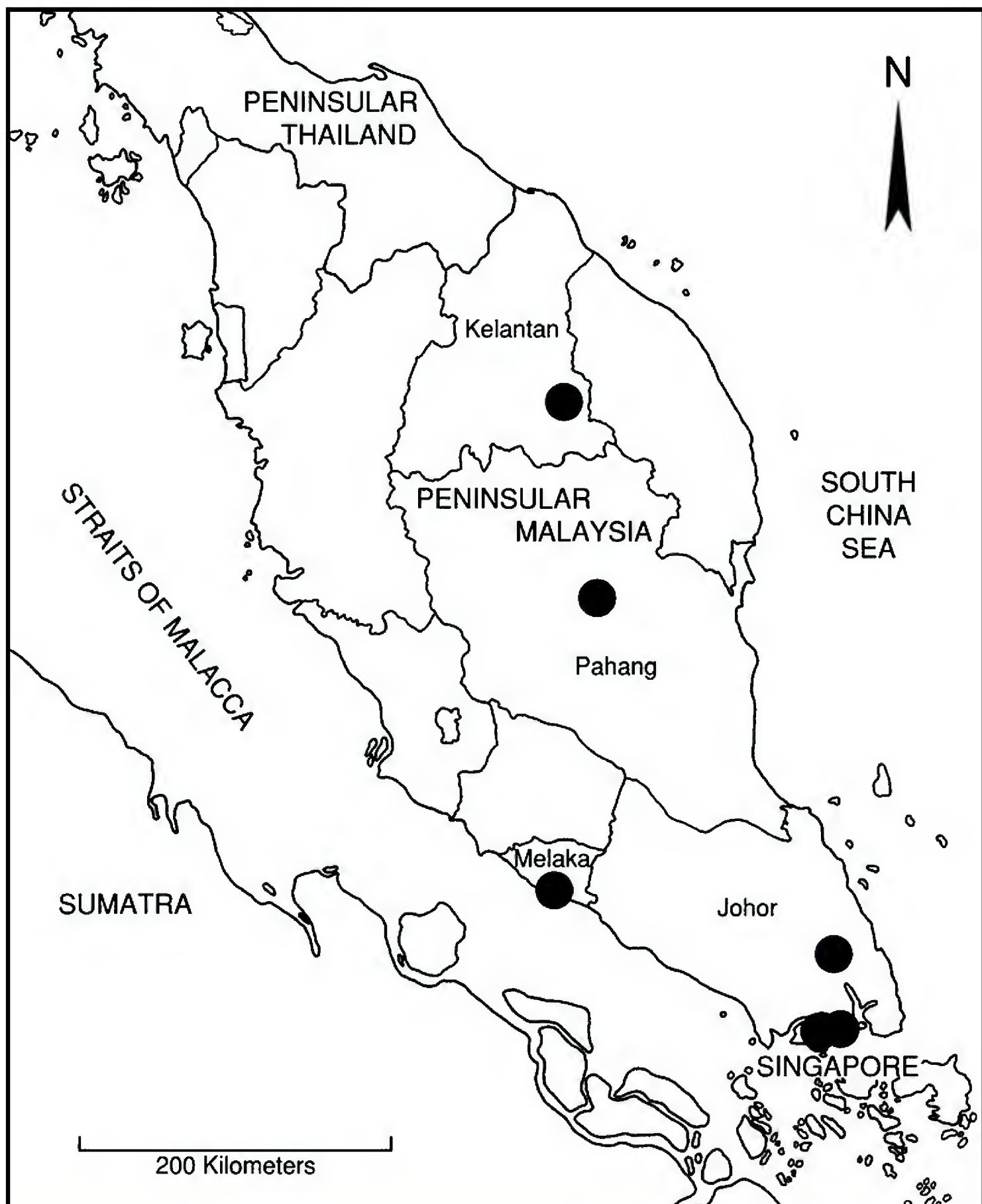


Fig. 3. Distribution of *Marsdenia maingayi* in the Malay Peninsula, indicated by black dots.

18 May 1983, Ng *FRI27408* (SING! barcode no. SING0122332); **Johor.** Gunung Pant, 22 May 1966, *Heaslett s.n.* (SING! barcode no. SING0122331). **SINGAPORE.** Changi, July 1885, *Hullett 147* (SING! 2 sheets, barcode nos. SING0003975 & SING0003974); Central Catchment Nature Reserve, MacRitchie Reservoir Park, 27 Aug 2012, *Low et al. LYW523* (K! SING! barcode no. SING0166282)



Fig. 4. The dark brown skipper, *Quedara monteithi monteithi* (Wood-Mason & de Nicéville, 1887), was spotted visiting *Marsdenia maingayi* flowers. (Photo: W.F. Ang)

ACKNOWLEDGEMENTS. We would like to thank the Keepers and Curators of K, KEP and SING for permission to examine specimens in their collections; National Parks Board for permission to access and obtain herbarium collections in the MacRitchie Reservoir Park, Central Catchment Nature Reserve. Much help in obtaining literature was kindly provided by Prof. H.T.W. Tan and Dr. K.Y. Chong (National University of Singapore); and Dr. P.I. Forster (Queensland Herbarium, Australia). A.T. Gwee (SING) helped with initial identification of the specimen, and Serena Lee (SING) provided BRAHMS support; Timothy Harris, Elizabeth Woodgyer, and Dr. David Goyder are thanked for facilitating type images from Kew; and three senior members of the ButterflyCircle Group (Singapore) and Anuj Jain (NUS) assisted with the identification of the butterfly photographed. Finally, we would like to express our appreciation to the two reviewers, Dr. David J. Middleton and Dr. Michele Rodda, for their constructive comments in improving this manuscript.

References

- Bachman, S., Moat, J., Hill, A.W., de la Torre, J. & Scott, B. (2011) Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. In: Smith, V. & Penev, L. (eds) e-Infrastructures for data publishing in biodiversity science. *ZooKeys* 150: 117–126. (Version BETA)*
- Brown, R. (1810) *Prodromus Flora Novae Hollandiae et Insulae van Diemen*. Nuremberg: Leonard Schrag. 590 pp.

- Chong, K.Y., Tan, H.T.W. & Corlett, R.T. (2009) *A Checklist of the Total Vascular Plant Flora of Singapore: Native, Naturalised and Cultivated Species*. 273 pp. Singapore: National University of Singapore, Raffles Museum of Biodiversity Research.
http://rmbr.nus.edu.sg/raffles_museum_pub/flora_of_singapore_tc.pdf (accessed on 14 Nov 2012).
- Davison, G.W.H. (2008) The Red List Categories. In: Davison, G.W.H., Ng, P.K.L. & Ho, H.C. (eds) *The Singapore Red Data Book: Threatened Plants and Animals of Singapore*. 2nd edition. Pp. 1–4. Singapore: Nature Society (Singapore).
- Forster, P.I. (1995a) New names and combinations in *Marsdenia* (Asclepiadaceae: Marsdenieae) from Asia and Malesia (excluding Papusia). *Austral. Syst. Bot.* 8: 691–701.
- Forster, P.I. (1995b) Circumscription of *Marsdenia* (Asclepiadaceae: Marsdenieae), with a revision of the genus in Australia and Papuasias. *Austral. Syst. Bot.* 8: 703–933.
- Gamble, J.S. (1908) *Stephanotis* (Asclepiadaceae). In: King, G. & Gamble, J.S. (eds) Materials for a flora of the Malayan Peninsula, no. 19. *J. Asiat. Soc. Bengal* 74(2): 549–550.
- Hansen, D.M., Olesen, J.M., Mione, T., Johnson, S.D. & Müller, C.B. (2007) Coloured nectar: distribution, ecology, and evolution of an enigmatic floral trait. *Biol. Rev.* 82: 83–111.
- Hooker, J.D. (1885) *Flora of British India*. Vol. 4. L. London: L. Reeve & Co. Ltd.
- IUCN (2001) *IUCN Red List Categories and Criteria: Version 3.1*. 2nd ed. Switzerland, Gland and UK, Cambridge: IUCN.
- Mabberley, D. (2008) *Mabberley's Plant-book: a portable dictionary of plants, their classification and uses*. 3rd ed. Cambridge: Cambridge University Press.
- Ridley, H.N. (1923) *The Flora of the Malay Peninsula*. Vol. 2. London: L. Reeve & Co. Ltd.
- Tan, H.T.W., Tan, B.C., Tan, K.X., Ali bin Ibrahim, Chew, P.T., Chua, K.S., Duistermaat, H., Ganesan, S.K., Goh, M.W.K., Gwee, A.T., Kiew, R., Lee, S., Leong, P.K.F., Lim, J., Lok, A.F.S.L., Loo, A.H.B., Lum, S.K.Y., Morgany, T., Saifuddin bin Suran, Sim, S., Haji Samsuri bin Haji Ahmad, Wee, Y.C., Yap, K.F., Yeo, C.K. & Yong, J.W.H. (2008) Checklists of threatened species: seed plants. In: Davison, G.W.H., Ng, P.K.L. & Ho, H.C. (eds) *The Singapore Red Data Book: Threatened Plants and Animals of Singapore*. 2nd ed. Pp. 213–245. Singapore: Nature Society (Singapore).
- Thiers, B. (2013) [continuously updated] Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/> (accessed on 11 Oct. 2013)
- Wood-Mason, J. & de Nicéville, L. (1887) List of lepidopterous insects collected in Cachar by Mr. Wood-Mason, part II, Rhopalocera. *J. Asiat. Soc. Bengal* 55(4): 343–393, pl. 15–18.